

The first elliptical orbit calculated by Mr. J. C. Chandler, using observations from September 18 to October 20, gave a period of about 4000 years.

Afterwards Mr. Kreutz, using observations from September 8 to November 14, gave a period of 843 years, and lately Mr. Morrison, keeping observations from September 19 to December 11, has an elliptical orbit with only 642.5 years.

This fact induces me to believe that an accurate study of the perturbations of the motion of this comet may be as important as it was for Biela's comet.

It is my purpose to go, as far as I can, through a complete discussion of all the observations, and I shall be very glad if those of your readers, who are possessors of good unpublished remarks both about the appearance and about the positions of the comet, would kindly let me know of them.

E. RISTORI

13, Pembridge Crescent, Bayswater, W., January 30

### The Aurora of November 17, 1882

I SHOULD like to ask H. J. H. Groneman whether he tried to find out if a curved path for the auroral beam would agree better with the observations than a straight one; because, if it was purely an auroral phenomenon, we should naturally expect its path to be a curve, maintaining a uniform height above the surface of the earth, and to be approximately a small circle having its centre at the magnetic pole, this being the ordinary position of the auroral arches. Of course the motion of the parts of the arch is often not exactly in this direction, because the arch has frequently a transverse motion in addition to the movements that take place longitudinally; and if there was any such transverse motion in the case of this beam, that would prevent its moving strictly along a parallel of magnetic latitude, though it is hardly likely it would deviate far from it. It would be well to ascertain whether such a motion would not agree better with the observations of the beam than Dr. Groneman's hypothesis that it was in a straight line; for the establishment of a curved motion would do away with the idea that the phenomenon was caused by a meteor.

In the other cases cited by Dr. Groneman of supposed meteoric masses passing through our atmosphere and producing auroral effects, the paths, so far as given, seem all to have been approximately along the parallels of magnetic latitude, which circumstance militates against their having had anything to do with meteors, because these traverse the atmosphere in all directions, and would be just as likely to go in a northerly or southerly direction as in an easterly or westerly one. Possibly, however, Dr. Groneman's theory may be that meteors only produce an auroral effect when they happen to go in such directions as may be calculated to produce it.

Sunderland, January 29

THOS. WM. BACKHOUSE

As Dr. Groneman in his most interesting paper on the phenomenon of November 17 asks for my authority for the Swedish observation, I may say that I merely saw it in the "Notes" in NATURE (vol. xxvii. p. 113). There seems a misprint in that statement, however, as "Eskibstuna, fifty-four miles south of Stockholm" would be in the sea, whereas Eskibstuna is fifty-four miles west of Stockholm.

As the spectroscopic observation is said to put the auroral nature of the "spindle" beyond doubt, I would observe that until we know that gas excited by the passage of particles through it at fifteen miles a second does not give the same spectrum as when incandescent by an electric discharge, the observation of certain lines cannot prove anything of the exciting cause. Further, a good deal of the light might be reflected sunlight, as that would be scattered over the whole spectrum, and would thus be masked by the faint diffused spectrum of the moonlight at the time.

Bromley, Kent

W. M. F. PETRIE

REFERRING to Dr. Groneman's communication, possibly it may be of service to say that at 9 p.m., October 14, 1870, besides some ruddy auroræ, chiefly in the west and north, I saw a band having a very close resemblance to that figured in the illustration, p. 297. It, however, stretched all the way across the sky from west to east, and continued for some time without much apparent alteration in figure or locality. An appointment called me away before it had vanished.

Cambuslang, January 26

HENRY MUIRHEAD

### The Sea Serpent

I HAVE seen four or five times something like what your correspondent describes and figures, at Llandudno, crossing from the Little Ormes head across the bay, and have no doubt whatever that the phenomenon was simply a shoal of porpoises. I never, however, saw the head your correspondent gives, but in other respects what I have seen was exactly the same; the motions of porpoises might easily be taken for those of a serpent; once I saw them from the top of the Little Orme, they came very near the base of the rock, and kept the line nearly half across the bay.

JOSEPH SIDEBOTHAM

Erlesdene, Bowdon, January 26

### Influence of "Environment" upon Plants

REFERRING to Prof. Thiselton Dyer's letter on the above subject in NATURE (vol. xxvii. p. 82), it may interest your readers to know that I have had several trees of *Acacia dealbata* 30 feet high, in the open air, in flower for ten days past, but not so fully as they will be in a fortnight's time. I have had *Desfontainia spinosa* in flower during the past eight months; this shrub is 6½ feet high, and all in the open air.

Rosehill, Falmouth, January 29

HOWARD FOX

### THE PEAK OF TENERIFFE ACTIVE AGAIN

A PRIVATE letter which I have just been privileged to see, from a native lady in Santa Cruz to her sister in this country, tells how the inhabitants of that present capital of Teneriffe had remarked for several months past, that there was no snow on the upper part of the Peak; though all the "Cumbree," or moderately high land over the rest of the island, was whitened with it in the usual manner for the season. But within the past few days, "fire, like three great bonfires" had been seen on the summit of the Peak, and a lava stream had begun to flow down from it.

Now this is interesting both chronologically, and chorographically. Chronologically, I had remarked at p. 150 of my little book "Teneriffe an Astronomer's Experiment," (published in 1858), that the lava eruptions there only break out about once in a century; the last eruption having occurred in 1798, and the previous one in 1703; and now we have one in 1883, but in what part of the mountainous island called Teneriffe has this last eruption appeared?

So far as I can gather from the said private letter, it has issued, if not from the very mouth of the craterlet which forms the tip-top of the Peak, yet from its sides or foot where it stands on a filled up crater of much larger size, otherwise to be looked on as the Peak's proper and effective summit; and it is from that crater's lips that have proceeded all the later, and yet prehistoric, streams of black lava, which score and frill the Peak on every side; and contrast so strikingly with the far more ancient red, and the still more ancient, more abundant, and once hotter yellow streams from the older and larger craters lower down, before ever yet, the Peak, or final cinder heap, was formed.

But though in the Nature-primeval history of the Mountain, the black, unoxidised lava streams of the Peak, were its latest exudations, still nothing more of that kind was locally expected to occur there within the human period. This was partly because no addition to them had been made since the Spanish Conquest; and partly because the lava outflow of 1798 avoided the Peak, and broke out on the Western side of the general mountain mass, while the eruptions of 1703, which threatened the town of Guimar to the south, and destroyed Garachico to the north, filling up its once beautiful bay—broke forth nearer the sea-level than the peak's top. Whence the idea arose, that the central vent of the peak must have clogged up with time, and that nothing more than its merry little jets of steam and sulphurous acid were to be looked for in that quarter; yet now we are told of red hot lava pouring forth.

Nevertheless on the whole, and in the long course of time, the forces of the grand old volcano may be dying out. For in an earlier work than any other that I had ever met with before about Teneriffe, I have lately read a very different account of the average state of the summit crater, to what it has been in, ever since the days of modern travelling and visitation began.

The book I allude to, in the possession of the Earl of Crawford and Balcarres, is an exquisitely illuminated MS. volume in vellum, by the Chevalier Edmund Skory, of the date of about 1582, and dedicated to that name so dear to all the students of Natural Science, viz.:

"Sir Frances Bacon,  
"the knower and lover of all good Arts."

The very first dipping into its old MS. pages brought out a quaint proof of its antiquity, by its involuntary allusions to Garachico, as a city that was necessarily the island's chief delight and glory; the seat of its Government, the abode of its commerce, the place of all its shipping, and of course, because it was so prosperous, destined to live a queen for ever, and to be the joy of all peoples. Yet it is now, and has been for nearly two centuries as deserted as another Tyre; hardly fit to be the habitation of foxes, a mere howling wilderness of black rocks, for a few fishermen to spread their nets upon.

This happily preserved author then in the Earl's valuable library, who had abundant experience of Teneriffe more than a century previous to Garachico's Herculeum fate, speaks of—

"Great stones being, with noyse, fyre and smo'ke, many  
"times cast forth" out of the craterlet on the top of the peak.

Also that, "On the sommer time the fyers doe ofte breake forth from out the hole in the topp of this hill; into which, if you throw a great stone, it soundeth as if a great weight had fallen upon infinite store of hollow Brasse."

C. PIAZZI SMYTH

### JOHANN BENEDICT LISTING

ONE of the few remaining links that still continued to connect our time with that in which Gauss had made Göttingen one of the chief intellectual centres of the civilised world has just been broken by the death of Listing.

If a man's services to science were to be judged by the mere number of his published papers, Listing would not stand very high. He published little, and (it would seem) was even indebted to another for the publication of the discovery by which he is most widely known. This is what is called, in Physiological Optics, *Listing's Law*. Stripped of mere technicalities, the law asserts that if a person whose head remains fixed turns his eyes from an object situated directly in front of the face to another, the final position of each eye-ball is such as would have been produced by rotation round an axis perpendicular alike to the ray by which the first object was seen and to that by which the second is seen. "Let us call that line in the retina, upon which the visible horizon is portrayed when we look, with upright head, straight at the visible horizon, the horizon of the retina. Now any ordinary person would naturally suppose that if we, keeping our head in an upright position, turn our eyes so as to look, say, up and to the right, the horizon of the retina would remain parallel to the real horizon. This is, however, not so. If we turn our eyes straight up or straight down, straight to the right or straight to the left, it is so, but not if we look up or down, and also to the right or to the left. In these cases there is a certain amount of what Helmholtz calls "wheel-turning" (*Rad-drehung*) of the eye, by which the horizon of the retina is tilted so as to make an angle with the real horizon. The relation of this "wheel-turning"

to the above-described motion of the optic axis is expressed by Listing's law, in a perfectly simple way, a way so simple that it is only by going back to what we might have thought nature should have done, and from that point of view, looking at what the eye really does, and considering the complexity of the problem, that we see the ingenuity of Listing's law, which is simple in the extreme, and seems to agree with fact quite exactly, except in the case of very short-sighted eyes." The physiologists of the time, unable to make out these things for themselves, welcomed the assistance of the mathematician. And so it has always been in Germany. Few are entirely ignorant of the immense accessions which physical science owes to Helmholtz. Yet few are aware that he *became* a mathematician in order that he might be able to carry out properly his physiological researches. What a pregnant comment on the conduct of those "British geologists" who, not many years ago, treated with outspoken contempt Thomson's thermodynamic investigations into the admissible lengths of geological periods!

Passing over about a dozen short notes on various subjects (published chiefly in the Göttingen "*Nachrichten*"), we come to the two masterpieces, on which (unless, as we hope may prove to be the case, he have left much unpublished matter) Listing's fame must chiefly rest. They seem scarcely to have been noticed in this country, until attention was called to their contents by Clerk-Maxwell.

The first of these appeared in 1847, with the title *Vorstudien zur Topologie*. It formed part of a series, which unfortunately extended to only two volumes, called *Göttinger Studien*. The term Topology was introduced by Listing to distinguish what may be called qualitative geometry from the ordinary geometry in which quantitative relations chiefly are treated. The subject of knots furnishes a typical example of these merely qualitative relations. For, once a knot is made on a cord, and the free end tied together, its nature remains unchangeable, so long as the continuity of the string is maintained, and is therefore totally independent of the actual or relative dimensions and form of any of its parts. Similarly when two endless cords are linked together. It seems not unlikely, though we can find no proof of it, that Listing was led to such researches by the advice or example of Gauss himself; for Gauss, so long ago as 1833, pointed out their connection with his favourite electromagnetic inquiries.

After a short introductory historical notice, which shows that next to nothing had then been done in his subject, Listing takes up the very interesting questions of Inversion (*Umkehrung*) and Perversion (*Verkehrung*) of a geometrical figure, with specially valuable applications to images as formed by various optical instruments. We cannot enter into details, but we paraphrase one of his examples, which is particularly instructive:—

"A man on the opposite bank of a quiet lake appears in the watery mirror perverted, while in an astronomical telescope he appears inverted. Although both images show the head down and the feet up, it is the dioptric one only which, if we could examine it:—would, like the original, show the heart on the left side; for the catoptric image would show it on the right side. In type there is a difference between inverted letters and perverted ones. Thus the Roman V becomes, by inversion, the Greek  $\Lambda$ ; the Roman R perverted becomes the Russian  $\mathfrak{P}$ ; the Roman L, perverted and inverted, becomes the Greek  $\Gamma$ . Compositors read perverted type without difficulty:—many newspaper readers in England can read inverted type. \* \* \* The numerals on the scale of Gauss' Magnetometer must, in order to appear to the observer in their natural position, be both perverted and inverted, in consequence of the perversion by reflection and the inversion by the telescope."

Listing next takes up helices of various kinds, and discusses the question as to which kind of screws should be